Is this a question? Not for long.

The statement bias

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Abstract

Four experiments demonstrate a ‘statement bias’: questions are more often misremembered as statements than vice versa. Experiment 1 suggests that the bias increases with increasing item comprehensibility. This finding rules out that the statement bias is only due to the belief that statements are more prevalent in communication than questions are. Experiment 2 demonstrates that the statement bias is related to depth of processing at encoding. Experiment 3 shows that the bias occurs irrespective of the truth of the statement underlying the sentence. Experiment 4 shows that the statement bias is also obtained for sentences pertaining to products and services.

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Language serves a lot of functions and the same sentence make take on different meanings by virtue of the context in which it is used, or even depending on the intonation used when uttering the sentence. Language comprehension is therefore a complex issue. Understanding how people comprehend language in general may yield new insights as to how consumers understand product claims, in advertising consumer reports or disseminated in chat groups.

A number of recent studies have focused on how consumers deal with specific types of questions. For instance, Ahluwalia and Burnkrant (2003) have investigated under what circumstances rhetorical questions may increase or diminish persuasion. Morwitz, Johnson and Schmittlein (1993) demonstrated that asking intention questions may actually affect consumers' behavior, at least to the extent that intention questions are not considered to be persuasion attempts (Williams, Fitzsimons and Block 2004). Fiedler et al. (1996) found that asking presupposing questions trigger constructive processes that may distort factual memory later on (see also Loftus 1975). In the context of consumer behavior, this may imply that asking questions that presuppose the relation between an object and a desirable attribute may render the attitude towards the object more positive. Finally, embedding information in a hypothetical question has also been demonstrated to influence consumers' attitudes and subsequent choice (Fitzsimons and Shiv 2001).

Whereas the questions used in the studies above have very specific linguistic functions, in the current paper, we investigate the process underlying the comprehension of simple, neutral questions. We propose that, when people try to

comprehend a question, they represent the content as a proposition (i.e., as a statement) which may be stored in memory. Even if the question is subsequently identified and stored as such, the initially stored proposition might distort recall of the sentence format. As a result, a question may not be remembered as a question but rather as a statement. In the context of consumer behavior, this may imply that questions used in advertisements, for instance, may become confused with product claims. Clearly, the assumed propositional representation phase of sentence comprehension also implies that statements are not easily 'remembered' as questions. Indeed, the propositional representation of a statement is simply the statement itself. In sum, we predict that questions will be misremembered as statements more often than vice versa. We will refer to this asymmetric confusion pattern as the *statement bias*.

Findings of two studies are consistent with the postulated statement bias but are also open to alternative explanations. First, Fiedler et al. (1996) exposed their participants to several scenes. Afterwards, they had to evaluate whether certain objects had been present in the scenes. In between, some participants received a question about object X that had not been present in the scene and some participants did not. Participants were more likely to have 'seen' object X when they had received the question about object X than when they had not. This *questioning effect* was obtained even if the participants had correctly answered not having seen the object. Clearly, this finding is consistent with a statement bias. We suggest that the question 'Was there an object X?' may have been represented as 'There was an object X' during comprehension. This may have distorted correct recognition in a later phase.

However, the questioning effect may also have been the result of constructive memory processes. Indeed, Fiedler et al. (1996) showed that misrecognition of X was

much larger after presupposing questions than after non-presupposing questions. Presupposing questions already imply the presence of an object (e.g. 'Was object X made of Y?') whereas non-presupposing questions do not (e.g. 'Was there an object X?'). According to Fiedler et al., when attempting to answer a presupposition, people project object X in the scene. For non-presupposing questions, they project the scene and try to evaluate whether X was in the scene. Although the visual memory construction was considerably weaker in the case of non-presupposing questions, it might nevertheless be responsible for the questioning effect reported above. That is, the question 'Was there an object X?' still might have led some to project object X in the scene. As a consequence, the questioning effect shown in Fiedler et al.'s first two experiments are merely suggestive with respect to the existence of a statement bias. A more straightforward test for the statement bias would keep the possible memory construction process constant.

A second piece of suggestive evidence dates from the heydays of transformational grammar. This theory postulated that during comprehension, sentences are decomposed in a kernel and the grammatical transformations applied to the kernel (such as passive, negation, and questions; for a recent overview, see Townsend and Bever 2001). The theory implies that confusion rates between kernel and transformations are symmetric because the transformational distance is considered Euclidian. Inconsistent with transformational grammar theory, Mehler presented confusion rates for questions that were asymmetric (1963, Table 1, p. 348). Clifton and Odom (1966) also measured dissimilarity between kernels, question and other transformations, and also reported asymmetries (experiments 1 and 2). However, they attributed the asymmetries in their studies and Mehler's to a "greater frequency of use in language" (i.e. to the belief that statements occur more frequently

in everyday communication than questions do or, in other words, to a background bias) and not to the way sentences are processed.

To test the hypothesis that questions will be misrecognized as statements more often than vice versa, we use a forced choice paradigm: Participants are presented with statements and questions. Later on, they receive the same content in both statement and question format and they then have to identify which format they have seen earlier. Our prediction is that more questions will be misidentified as statements than vice versa.

Of course, it is possible that part of this statement bias is not due to the propositional representation process that we postulate but rather to the fact that people simply assume that, in any communication, statements are more prevalent than questions. Therefore, in case of doubt they might choose statement. We will refer to this 'rational guessing' as the *background bias* (cf. Clifton and Odom 1965). We will show that although background bias may play a role, it can not explain the entire the statement bias.

In three experiments, we demonstrate the statement bias and show that it is attenuated when comprehension is hindered and boosted when additional semantic processing is required. In the first experiment, we manipulate the ease of comprehension. In the second experiment, we also manipulate the extent of semantic processing. In experiment 3, we show that the statement bias is independent of the truth of the proposition that is represented during comprehension. As we wanted to study the statement bias without the added complexity of coping attempts with persuasive messages, we used biology and mathematics sentences rather than sentences about products or services. In a fourth experiment, we therefore replicated the statement bias using sentences pertaining to products and services.

EXPERIMENT 1

The aim of experiment 1 is to show the confusion asymmetry between statements and questions and to demonstrate that comprehension plays an important role in this bias. We presented participants with sentences that were either comprehensible (biology items; e.g. Fresh water snakes swim upside down for about half of the time.) or rather incomprehensible (mathematics items; e.g., 'Any memomorph function is a homomorph function'). Half of the sentences in each domain were shown in statement format and half in question format. We expected that questions would be mistaken for statements more often than vice versa. Further, because propositional representation requires comprehension, we expected a larger statement bias for biology than for mathematics sentences. If the sentence is incomprehensible, people may not represent it as a proposition. Any remaining bias for the mathematics items, then, may reflect a background bias (cf. Clifton and Odom 1965).

Method

Participants. Sixty-four college students with various majors participated in exchange for a participation fee of 6 Euro (€1 ˜ $1). The study was part of a series of unrelated studies taking about an hour.

Material. A list of 20 biology and 20 mathematics statements was compiled. A sample of students of the same population (n = 15) rated the truth of the statements on

a scale ranging from 0 (I know this statement to be untrue) to 10 (I know this statement to be true). The neutral midpoint reflected uncertainty. Twelve mathematics and twelve biology statements with average closest to 5 were selected.

Procedure. Participants saw the selected sentences on a computer screen and first had to estimate what percentage of the population would actually understand the sentences. Per domain, half of the items were formulated as questions and half as statements (randomly selected per individual). Then participants received all the sentences both as a question and as a statement one above the other (randomized order) on paper. Participants had to indicate which of the two formats they had seen: statement or question.

Results and discussion

Biology items (M = 66.23) were rated more comprehensible than mathematics items (M = 43.73), $t(63) = 19.00$, $p < .001$, validating our comprehensibility manipulation.

For each participant, we calculated the relative 'bias towards statement' for biology and mathematics separately. Relative bias was defined as the number of questions that was incorrectly remembered as statements, divided by the total number of confusions for that participant and domain (i.e. the sum of the number of statements that was incorrectly remembered as questions and vice versa). One participant made no errors for either domain and was discarded (as relative bias is then undefined). For interpretation purposes, 0.5 was subtracted from the individual

relative biases. As a result, zero implies no bias; a positive number indicates bias towards statement and a negative number implies bias towards question.

For biology items, the relative bias was .33, $t(62) = 12.28$, $p < .001$. For mathematics items, it was .11, $t(62) = 3.24$, $p < .01$. The relative bias was larger for biology items than for mathematics items, $t(62) = 5.29$, $p < .001$. Background bias could account for the bias for mathematics items, but not for the substantial difference between domains. The fact that the bias is much stronger for the biology items strongly suggests that comprehensibility plays an important role. This is consistent with our hypothesis that the bias is mostly due to the propositional representation step of comprehension.

However, the current findings are also amenable to an alternative explanation. It is possible that the relative bias is not caused during *encoding* but rather during the *test* phase of the experiment. Indeed, participants may have decided on statement or question relying on the relative fluency with which they could process the two response options (cf. Whittlesea 1993). For biology, statements may have been much easier to process than questions. As a result, participants may have indicated more often 'statement' than 'question'. For mathematics, in contrast, the difference in processing fluency between statements and questions may have been far less pronounced, resulting in a lower bias. In Experiment 2, we seek further support for our position that the confusion occurs at encoding by manipulating semantic processing *at encoding*. In addition, we will remove background bias by giving participants categorization processing goals, which have been shown to result in rather accurate estimation of the relative sizes of the categories involved (e.g., Freund and Hasher 1989).

EXPERIMENT 2

The aim of experiment 2 is twofold. First, we want to replicate the findings of the first experiment. Second, we want to find additional evidence for the proposed involvement of propositional representation by ruling out the 'response' explanation.

That is, we try to obtain a clearer picture of the role of the propositional representation stage of comprehension in the statement bias. First, we attempt to remove the background bias by asking our participants to categorize each sentence as either a question or a statement. Previous studies have shown that categorization into relevant categories at encoding indeed enables people to estimate the relative frequencies of the categories fairly accurately (e.g., Freund and Hasher 1989).

Second, in addition to the categorization task, some participants also have to judge the comprehensibility of the items (as in experiment 1) whereas others do not. As more processing (and consequently an enhanced propositional representation) is involved when participants have to judge the comprehensibility than when they do not, we expect a higher bias following judgment and categorization than following mere categorization. Third, we also manipulated the punctuation: For half of the participants, the end punctuation is present (as in experiment 1), whereas for the other half, it is absent. The presence versus absence of end punctuation is assumed to independently affect the propositional representation process. Indeed, given the categorization instructions, end punctuation unambiguously informs on the sentence format without the need for additional processing, and hence does not require propositional representation. In contrast, in the absence of end punctuation, participants have to read the entire sentence, during which the content may be represented as a proposition. So, end punctuation is expected to decrease the

statement bias. It should be noted that according to a 'response' explanation of the statement bias, end punctuation and the comprehensibility judgment task should not affect the magnitude of the statement bias because these factors exert their influence solely at the encoding phase.

Clearly, in the condition involving mere categorization and end punctuation, participants do not have to process the sentence. As a result, no propositional representation is required. Consequently, we do not expect a statement bias in this condition. Further, considering that categorization results in a fair knowledge of the relative distribution of questions and statements we expect no statement bias to remain in this condition.

In summary, the experiment is a 2 × 2 × 2 design. All participants have categorization goals. In addition, we manipulate end punctuation (between subjects), comprehension evaluation instructions (between subjects) and domain (within subjects). We expect three main effects according to the effect the manipulations have on comprehension. End punctuation should reduce the statement bias, whereas comprehension evaluation instructions should increase it. Again, we expect the statement bias to be higher for biology items than for math items.

Method

Participants. One hundred and fourteen college students with various majors participated in exchange for a participation fee of 6 Euro (€1 ˜ $1). The study was part of a series of unrelated studies taking about an hour.

Procedure. The material was identical to that of experiment 1. Participants

were randomly assigned to one of the cells of Processing (categorization + comprehensibility judgment versus mere categorization) by Punctuation (present versus absent) design. All participants had to categorize the sentences as either question or statement by clicking radio buttons indicating ‘statement’ and ‘question’ (categorization). In addition, half of the participants had to estimate what percentage of the population would actually understand the sentences (comprehensibility). As in experiment 1, per domain, half of the items were formulated as questions and half as statements (randomly selected per individual). However, in contrast to experiment 1, for half of the participants, no punctuation was present whereas for the other half, the sentences contained the usual punctuation (as in experiment 1). Finally, participants engaged in the forced choice task on PC.

Results and discussion

As intended, biology items (M = 43.76) were more comprehensible than mathematics items (M = 25.75), $t(1,55) = 9.42$, $p < .001$. For each participant, we then calculated the relative bias towards statement for biology and mathematics separately.

The relative biases for mathematics could be calculated for all participants, whereas for biology they could be calculated for only 112 of the 114 participants. The relative biases were analyzed using a 2 (Processing: categorization + comprehensibility versus mere categorization) by 2 (Punctuation: present versus absent) by 2 (Domain: biology or mathematics) ANOVA. We used a mixed model approach because in contrast to univariate and multivariate repeated measures ANOVA, it does not imply dropping a participant if one of the two biases is missing.

As expected, the analysis yielded three main effects; all other effects were not significant, all Fs < 2.01, all ps > .15. The main effect of Domain, $F(1,109) = 10.25$, $p < .01$, revealed a higher bias for biology ($M = .20$, $t(107) = 7.29$, $p < .001$) than for mathematics ($M = .10$, $t(110) = 3.52$, $p < .001$). This replicates Experiment 1 and supports the hypothesis that propositional representation is more difficult for less comprehensible items, resulting in a substantially lower statement bias.

The main effect of Punctuation, $F(1,110) = 7.03$, $p < .01$, showed a higher bias if punctuation was absent ($M = .21$, $t(109) = 6.96$, $p < .001$) than if it was present ($M = .09$, $t(111) = 2.90$, $p < .01$). This is consistent with the notion that, given categorization instructions, punctuation reduces the need for processing. Finally, the main effect of Judgment, $F(1,110) = 16.00$, $p < .001$, demonstrated a higher bias when participants made a comprehensibility judgment ($M = .24$, $t(110) = 7.61$, $p < .001$) than when they did not ($M = .06$, $t(110) = 2.06$, $p < .05$). This is consistent with the notion that evaluating comprehensibility requires deeper processing. In all, the three main effects (domain, punctuation, and comprehensibility) support the hypothesis that depth of processing is positively related to the bias. Table 1 shows the biases in every cell. Additional support for the hypothesis that propositional representation drives the bias comes from the finding that no bias remains in the punctuation condition with categorization instructions. Irrespective of domain, the bias is not significantly different from zero (both ts < 0.64, both ps > .64). Illustratively, in the condition involving maximal processing (biology items, evaluating comprehensibility, categorization as question vs. statement without punctuation information), the bias (0.36) is close to its maximum (0.50). That is, for every seven errors a participant makes, six confuse a question with a statement (raw bias of .86).

Table 1. Bias toward Statement as a Function of Processing and Punctuation (SE in parentheses; subscripts denote the statistical significance of the biases in each cell).

	Mere categorization (n = 58)	Categorization + judgment (n = 56)
Mathematics		
Punctuation	.01 (.055)	.10 * (.057)
no punctuation	.02 (.053)	.26 *** (.053)
Biology		
Punctuation	.03 (.056)	.23 *** (.060)
no punctuation	.20 *** (.054)	.36 *** (.054)
Overall		
Punctuation	.02 (.044)	.17 *** (.046)
no punctuation	.11 ** (.042)	.31 *** (.042)

* p = .068; ** p < .05; *** p < .001

EXPERIMENT 3

In the previous experiments, we demonstrated the existence of the statement bias. Questions are more often misrecognized as statements than vice versa. Moreover, the statement bias is stronger for comprehensible than for incomprehensible sentences (exp. 1 and 2). Finally, processing depth at *encoding* is related to the statement bias (exp. 2). The latter finding ruled out an explanation in terms of *relative* fluency of the two options (i.e. statement vs. question) during recognition. However, it still leaves open the possibility that *absolute* fluency during recognition drives (part of) the statement bias. Specifically, conceptually fluent statements (e.g. truisms) might seem so familiar that they are "recognized" more easily (cf. Whittlesea 1993).

To test this second 'response' explanation, we manipulated the plausibility of the statement underlying the sentence. In particular, we used blatantly true, blatantly false and plausible items. If the choice between statement and question depends on the fluency of the statement, then the statement bias should be more pronounced if the underlying statement is blatantly true than if it is merely plausible. In addition, it should be more pronounced if the underlying statement is plausible than if it is blatantly false. However, if comprehension at encoding drives the statement bias, the plausibility of a statement should not moderate the statement bias. Irrespective of the plausibility of the underlying statement, every question should be represented as a statement during the comprehension phase, and this process is believed to produce the asymmetric confusion between statements and questions during recognition.

In addition, to further demonstrate the importance of comprehensibility in the statement, we chose to manipulate comprehensibility within domains rather than across domains. This also reduces the concern that the domain effect found in experiments 1 and 2 would be related to another difference between the biology and mathematics items than their comprehensibility. Participants either saw comprehensible biology items or incomprehensible biology items. In addition, the plausibility of the comprehensible items varied from blatantly true, over plausible but unknown, to blatantly false. Note that we could not vary the plausibility of incomprehensible items because truth evaluation requires comprehension. If comprehension alone underlies the statement bias then the bias should be lower for incomprehensible items than for comprehensible items, irrespective of their truth value. For the comprehensible items, the plausibility of the items should not affect the bias.

Method

Participants. One hundred and fifty-eight college students with various majors participated for either course credit or payment (€ 6) in an experimental session which contained the current experiment. Type of credit did not exert any influence and is not discussed further.

Material. The 12 mathematics items of the previous experiments were used as filler items. A list of new biology items was compiled consisting of 24 items that were comprehensible but for which the correctness was not obvious, 24 items that were comprehensible and blatantly true, 24 items that were comprehensible and blatantly false, and 24 items that were incomprehensible (and by consequence for which the correctness was not obvious). The incomprehensible items were produced by substituting Latin terms for the common terms in the comprehensible items. In a pretest, a different sample of students (n = 79) of the same population rated the truth of the statements on a scale ranging from 0 (I know this statement to be untrue) to 10 (I know this statement to be true). The neutral midpoint was reserved for statements for which participants did not know whether or not the statement was true. We selected the best 12 biology items of each of the four types: incomprehensible, comprehensible unknown truth, comprehensible true and comprehensible false. The plausibility of the incomprehensible items did not differ from the plausibility of the "comprehensible unknown truth" items. "Comprehensible true" items were significantly more plausible than either of the former whereas "comprehensible false" items were significantly less plausible than all the former.

Procedure. All participants had to indicate how comprehensible the sentences were on a scale from 0 (not comprehensible at all) to 10 (entirely comprehensible). Participants received the usual mathematics items and one of the four types of biology items (incomprehensible [e.g., Tamandoea belong to the species of edentata], comprehensible unknown truth [e.g., Ant eaters have few or no teeth], comprehensible true [e.g., Ant eaters eat termites as well as ants], and comprehensible false [e.g., Ant eaters eat mostly plants]). As before, half of the items within each domain were presented as questions and half as statements (random selection per participant). The forced choice task was again administered on PC.

Results and discussion

As intended, incomprehensible sentences (M = 3.89) were rated as less comprehensible than unknown (M = 9.64), true (M = 9.77) or false sentences (M = 9.75), all pairwise ts > 28.0, all ps < .001. Within the three types of comprehensible sentences, no differences were obtained, all pairwise ts < .63, all ps > .52.

The relative bias for mathematics was .21, $t(151) = 11.31$, $p < .001$. Across types, the relative bias for biology was .32, $t(155) = 16.99$, $p < .001$. As expected, however, a lower bias was obtained for incomprehensible biology items (M = .26) than for comprehensible biology items (M = .34), $F(1,152) = 1.92$, $p < .056$. Between the conditions involving comprehensible items, no significant differences emerged, $F(2,152) = 0.01$, $p > .90$ (the means are .345, .339 and .344 for incomprehensible, true and false items, respectively), suggesting that plausibility does not affect the bias, and hence, that the truth value of a sentence is tangential to the statement bias.

EXPERIMENT 4

The aim of experiment 4 is to replicate the statement bias using sentences pertaining to products and services. We refrained from using such sentences in the previous experiments because they raise the issue of whether or not consumers view them as persuasion attempts and try to cope correspondingly.

In the current experiment, we explicitly addressed the persuasion attempt issue: Half of the participants were led to believe that the sentences came from real advertisements whereas the other half was explicitly told that the sentences were fictitious. We had no clear expectations about this manipulation. On the one hand, participants may pay more attention to the linguistic format for 'real' sentences than for 'fictitious' sentences. This would result in a lower bias for sentences that allegedly came from real advertisements. On the other hand, sentences coming from real advertisements may be processed more deeply. This would result in a more pronounced bias for sentences that allegedly came from real advertisements.

Method

Participants. Forty-six psychology students participated for course credit. The study was part of a series of unrelated studies taking about an hour.

Material. Using a list of 30 product sentences, two versions of 15 questions and 15 statements were created. Fifteen randomly selected sentences were questions in the first version and statements in the other version.

Procedure. Participants received one of the two versions of 30 sentences on paper. Half of them were told that the sentences came from real advertisements and their task was to indicate for each sentence whether it had come from a spoken or a written advertisement. The other half were told that the sentences were fictitious. They had to estimate what percentage of the population would actually understand the sentences. Afterwards, participants received all the sentences both as a question and as a statement one above the other (randomized order) on paper and had to indicate which of the two formats they had seen: statement or question.

Results and discussion

For each participant, we calculated the relative 'bias towards statement'. The relative bias was approximately the same for sentences from real advertisement (M = .20) than for fictitious sentences (M = .23), $F(1,44) = 0.23$, $p > .63$. Importantly, the relative bias was significantly above zero in both conditions, both ts > 4.30, both ps < .001. This replicates the statement bias within the realm of consumer behavior. In addition, these findings suggest that similar effects are obtained, whether or not the sentences are drawn from persuasive communication. This, in turn, suggests that the conclusions drawn in experiments 1 to 3 are also valid for sentences that appear in persuasive communication like sentences pertaining to products and services.

GENERAL DISCUSSION

Experiments 1, 2 and 3 are consistent with the idea that during comprehension of a sentence, people represent the sentence as a proposition. This proposition may be stored in memory, leading to confusion as to whether the given sentence was a question or a statement. Moreover, this confusion is asymmetric in nature: Questions are more often confused with statements than vice versa. Factors that promote propositional representation, like sentence comprehensibility and depth of processing, strengthen the statement bias. Factors that do not affect comprehensibility such as the truth value of a sentence do not affect the statement bias, which provides divergent validity. Experiment 4 demonstrates that the statement bias effect is also relevant for consumer behavior. In addition, whether or not the sentences were featured in a persuasive context does not affect the statement bias.

The statement bias implies that the illusory truth effect may be more general than initially believed. The illusory truth effect is that familiar statements are considered as more veridical than unfamiliar ones (Begg, Anas, and Farinacci 1992). Usually, familiar statements are statements that have been presented before. The statement bias implies that a statement may also be familiar because it is the propositional representation of a question. As a result, a statement's perceived veridicality may increase not only as it is presented more often, but also as it is featured more often in a question.

Related to the latter point, the statement bias may have implications for public policy regarding, for instance, advertising practice. It is forbidden by law to provide consumers with untrue, embellished, information if a majority of the consumers actually believe the claim to be true (Preston 1994). The statement bias suggests that asking questions induces the risk that consumers believe the 'information'. So, merely asking whether brand X is superior to its competitors might be remembered as if

brand X is actually superior. Moreover, consumers are not used to approach questions as persuasion tactics, and hence do not possess persuasion knowledge to deal with them (Friestad and Wright 1994). This lack of knowledge of how to deal with questions might increase consumer vulnerability to this tactic. Therefore, the existence of the statement bias suggests that it should be forbidden to ask questions for the sake of creating an advantage because of the statement bias.

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